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PROSTHODONTICS™

NEWSLETTER

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IN THIS ISSUE:

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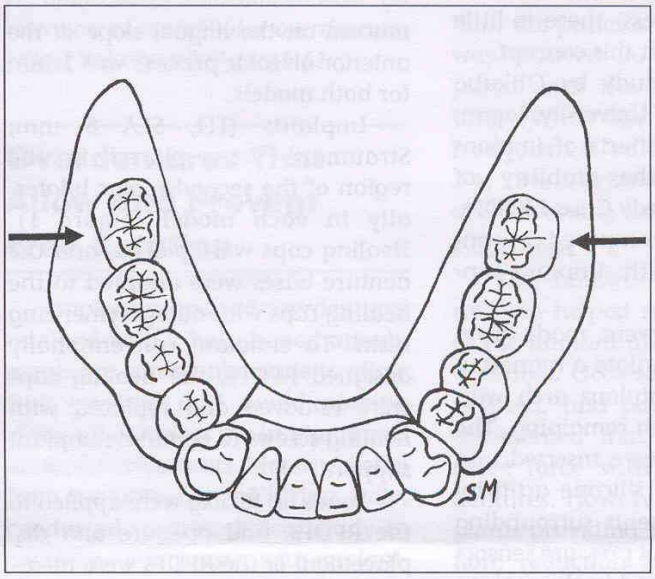

Placing an implant bilaterally in the second molar region (arrows) to support the denture bases for a Kennedy Class I removable partial dental prosthesis can enhance support, stability, masticatory efficiency and patient comfort. (See Implant Support for Extension-base Removable Partial Dentures inside.)

Overdentures

Overdentures were originally designed to be placed over retained natural teeth to enhance retention and support for the denture and to reduce the potential for long-term bone loss beneath the denture. Soon after the introduction of osseointegrated implants to North America, new and innovative treatment approaches were attempted, beyond their original intent of supporting screw-retained fixed complete dentures in edentulous mandibles. Currently, implants are used to support complete-arch fixed restorations, fixed partial dental prostheses, single crowns and overdentures. This issue of *Prosthodontics Newsletter* is devoted to studies related to overdentures.

Implant Support for Extension-base Removable Partial Dentures

A Kennedy Class I removable partial dental prosthesis (RPDP) derives its support from the abutment teeth and edentulous ridges. This type of prosthesis has been associated with bone resorption and chronic tissue soreness. Placement of 1 implant in the region of the last molar on each side of the arch has the potential to eliminate many of the problems associated with Class I RPDPs. Nevertheless, there is little research to support this concept.

An in vitro study by Ohkubo et al from Tsurumi University, Japan, investigated the effects of implant placement on the stability of mandibular Kennedy Class I RPDPs. The investigators compared conventional RPDPs with implant-supported RPDPs.

Two models were made from epoxy resin to simulate a mandibular partially edentulous arch with the 6 anterior teeth remaining. The 6 anterior teeth were inserted into their sockets with silicone artificial periodontal ligaments surrounding the roots. Five small pressure sensors (Kyowa) were placed in the regions of the right and left first molars, the right and left first premolars, and the midpoint of the lingual slope of the anterior alveolar process. Five chromium-cobalt, extension-base RPDPs were fabricated. The edentulous ridges of 1 model were relieved 1 mm, and the ridges on the other model were relieved 2 mm. Silicone impression material was placed in the relieved areas to simulate mucosal coverage of 1 mm and 2 mm. The mucosa on the lingual slope of the anterior alveolar process was 1 mm for both models.

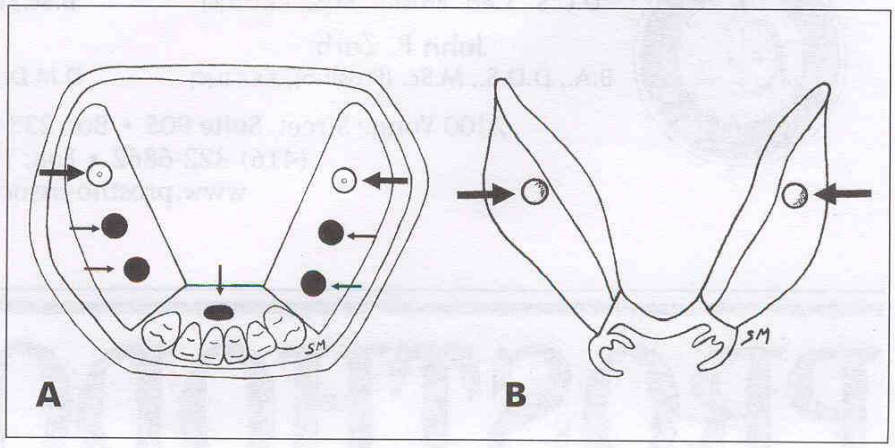

Figure 1. (A) Two implants were placed on the model bilaterally in the second molar region and healing caps were attached (large arrows). The model was also equipped with 5 pressure sensors (small arrows). (B) View of the fitted surfaces of the denture bases with recesses for implant support (arrows).

Implants (ITI, SLA 8 mm; Strauman) were placed in the region of the second molar bilaterally in each model (Figure 1). Healing caps were placed, and the denture bases were adapted to the healing caps with autopolymerizing resin. To simulate conventionally designed RPDPs, the healing caps were removed and replaced with healing screws to eliminate implant support.

Loads up to 5 kg were applied to the RPDPs, and pressure and displacement of the RPDPs were measured. Results indicated less pressure in the first molar region for the implant-supported RPDPs with both tissue thicknesses. No difference in pressure was noted in the first premolar regions for the 2 RPDP designs. There was significantly less denture displacement with the implant-supported design.

Comment

Results of this study suggest that placement of 2 implants in the posterior mandible bilaterally for patients with Kennedy Class I RPDPs will improve the function and comfort of the RPDPs and reduce potential for bone loss.

Ohkubo C, Kurihara D, Shimpo H, et al. Effect of implant support on distal extension removable partial dentures: in vitro *assessment.* J Oral Rehabil *2007;34:52-56.*

Attachment Wear And Retention of Mandibular Overdentures

A study by Rutkunas et al from Vilnius University, Lithuania, evaluated the retentive properties of 4 stud and 5 magnetic overdenture attachments during linear (axial) and rotational (paraxial) dislodgements. In addition, they investigated the effects of simulated wear on the retentive properties of the attachments.

The magnetic attachment systems included in the study were:

- Magnedisc 500 (Aichi Steel Co.);
- Magfit EX 600W (Aichi Steel Co.);
- Magfit-RK (dome shaped; Aichi Steel Co.);
- Hyperslim 4013 (Hitachi Metals Co.); and
- Hyperslim 4513 (Hitachi Metals Co.).

The stud attachments were:

- OP anchor #4 (Inoue Attachments Co.);
- Locator root (pink; Zest Anchors);
- ERA overdenture (white; Sterngold); and
- ERA overdenture; (orange; Sterngold).

Linear dislodgement tests were performed on single attachments for each type. For each specimen, 10 dislodgements were performed to measure maximal retentive force (N) and range of retention (mm; separation in mm between the 2 components until retentive force was reduced to 1 N).

A mandibular model was made with 2 attachments, and a metal-reinforced mandibular overdenture was fabricated to fit the model. The mucosa was simulated with a 3-mm-thick silicone layer. This setup was used to measure retention during rotational dislodgements. Anterior, lateral and posterior rotational dislodgements were performed.

The effect of wear on the attachments was studied for the stud attachments only. A wear test was used to determine the minimal number of wear cycles required to simulate wear; wear was then simulated and the retentive tests (axial and paraxial) were repeated on the attachments.

Results indicated that, before the simulated wear, studs were more retentive than magnets. The orange ERA attachments were initially the most retentive. After simulated wear, the Locator attachments were the most retentive. Magnets recorded a lower range of retention (0.2–0.3 mm) when compared with stud attachments (0.5–1.1 mm).

Comment

When the overdenture was subjected to all types of rotational forces, retention was best with the Locator attachments. These attachments are easy to use. When excessive wear of the attachments results in loss of adequate retention, the male nylon components can be replaced in the overdenture quickly and easily.

Rutkunas V, Mizutani H, Takahashi H. Influence of attachment wear on retention of mandibular overdenture. J Oral Rehabil *2007;34:41-51.*

Overdentures That Allow and Prevent Free Rotation

Implant-supported overdentures retained with 2 ball-shaped attachments are commonly made to allow free rotation and avoid placing excessive stress on the implants and implant components. Menicucci et al from the University of Torino, Italy, conducted a pilot clinical study to compare load transfer with implant-supported overdentures that allow and do not allow free rotation of the dentures.

Three patients who had ≥7 years of experience wearing implant-supported overdentures retained with 2 ball attachments (Nobel Biocare) were selected for the study. Four strain gauges (Micron Instruments) were attached to the titanium abutments, and pressure sensors (Interlink Electronics) were embedded in the fitted surfaces of the denture bases at the level of the second premolar and first molar. Load cells (Interlink Electronics) were also used to measure occlusal loads during the tests.

The dentures were initially designed to prevent free rotation. Patients performed 6 10-second masticatory cycles, occluding on the load cell, with a 5-second pause between cycles. The dentures were then modified to produce a 1-mm gap between the metal frame housing the attachments and the abutments. This gap allowed free rotation. The masticatory tests were then repeated.

With the free-rotation condition, the patients' masticatory load was reduced 20–47% when compared with the nonrotating dentures. When the dentures rotated freely, stress values were reduced 2%, 28% and 30% for the 3 patients at the working-side abutment.

Comment

The dentures that allowed free rotation helped reduce the stresses at the implant abutments, which is desirable. Occlusal forces were also reduced, and patients subjectively commented that they could exert more force with the nonrotating dentures. However, with only 2 implants providing support and retention, reduction in the amount of total force directed to the dentures is probably desirable also. Because of the small sample size and lack of long-term follow-up, the clinical relevance of the results of this study can be questioned.

Menicucci G, Ceruti P, Barabino E, et al. A preliminary in vivo trial of load transfer in mandibular implant-retained overdentures anchored in 2 different ways: allowing and counteracting free rotation. Int J Prosthodont *2006;19: 574-576.*

Ball- vs Bar-retained Implant-supported Overdentures

Dental implants are commonly used to retain and stabilize complete dentures. Methods of attachment of a complete denture to supporting implants include bar retainers and stud retainers. A Dolder bar is a popular style of bar retainer. Ball-shaped stud attachments are also in widespread use.

The open space on the fitted surface of the denture is considerably greater with bar-retained overdentures when compared with ball-retained overdentures. It is conceivable that this large open space associated with bar retainers could harbor pathogenic plaque, leading to peri-implant inflammation.

A clinical study by Lachmann et al from Eberhard Karls University of Tübingen, Germany, investigated the effects of these 2 different attachment systems on the presence of 5 pathogenic bacteria and the concentration of inflammatory markers interleukin-1β (IL-1β) and prostaglandin E2 (PGE2) in the sulcular fluid of edentulous patients. Twenty-one edentulous patients with mandibular implant-supported overdentures scheduled for annual recall visits were initially selected. Of these 21 patients, 5 were treated with ball-retained overdentures. The remaining 16 patients were treated with implant-supported overdentures retained with Dolder bars. Five patients with bars were chosen from the group of 16 patients for the study. The parameters for their selection were pair-wise matching of age and gender compared with the group with ball attachments. These 10 patients made up the study population. The remaining 11 patients were not included in the study.

The mean age of the patients was 71 years, and their dentures had been worn on average for 7 years. Plaque and crevicular fluid samples were obtained from the soft tissues surrounding the implants. The plaque samples were analyzed for the 5 pathogenic bacteria, and the crevicular fluid was evaluated for the concentration of IL-1β and PGE2. Peri-implant probing depths, plaque scores, bleeding-on-probing scores, sulcular fluid rates and implant stability scores were also measured.

Results indicated healthy periodontal tissues surrounding the implants of patients in both groups. Minimal presence of 2 species of pathogenic plaque bacteria (*Prevotella intermedia* and *Porphyromonas gingivalis*) was found in 1 patient only. All other patients were free of the bacteria studied. The authors concluded that either attachment system could produce good results in healthy patients with acceptable oral hygiene practices.

Comment

Results of this study indicate favorable health of the peri-implant tissues for the 2 groups of patients studied, but there are obvious limitations to this study. The sample size was very small for both groups. Also, this cross-sectional survey evaluated patients who had worn implant-supported overdentures for an average of 7 years. Therefore, only successfully treated patients were enrolled in the study. Because patients with implant failures are more likely to experience these failures during the first year of service, evaluation of a larger group of patients, 6–12 months after treatment, might yield different results. Nevertheless, with these limitations in mind, the authors' conclusions appear valid, suggesting no difference between the 2 methods for patients who faithfully adhere to annual recall visits and practice good oral hygiene.

Lachmann S, Kimmerle-Müller E, Gehring K, et al. A comparison of implant-supported, bar- or ball-retained mandibular overdentures: a retrospective clinical, microbiologic, and immunologic study of 10 edentulous patients attending a recall visit. Int J Prosthodont *2007;20:37-42.*

NEXT:

- Survival of complete crowns and periodontal health
- Pulpal response to cemented porcelain inlays
- Clinical outcome of IPS Empress 2 crowns

Our next report features a discussion of these issues and the studies that analyze them, as well as other articles exploring topics of vital interest to you as a practitioner.